

02/08/99



U.S. PTO

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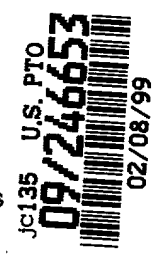
PATENT APPLICATION

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Applicant: Libor Nouzovsky et al.

Docket No. SIG99002

Title: Method and Apparatus for Recovering Data That was Transported Utilizing Multiple Data Transport Protocols



Date: 2/8/99

To the Honorable Commissioner
of Patents and Trademarks
Box Patent Application
Washington, D.C. 20231

REQUEST FOR FILING A NATIONAL PATENT APPLICATION

The applicants respectfully request that the above captioned patent application be accepted for examination. This patent application is a:

- ☒ new patent application
- ☐ continuation in part (CIP) of Application Serial No. [] filed on []
- ☐ divisional application of Application Serial No. [] filed on []
- ☐ continuation application of Application Serial No. [] filed on []

Accompanying this request is (as indicated by an "X" in the corresponding box):

- ☒ 1. 21 pages of specification, which includes the claims and abstract, and 5 sheets of formal drawings;
- ☒ 2. Combined Declaration and Power of Attorney;
- ☐ 3. An Information Disclosure Statement along with the references;
- ☐ 4. A petition to extend the response for a priority application identified above;
- ☒ 5. An assignment assigning all rights in the above referenced patent application to SigmaTel, Inc.;
- ☒ 6. An assignment recording cover sheet;
- ☒ 7. A verified statement establishing small entity status under 37 C.F.R. Sections 1.9 and 1.27;
- ☒ 8. A certificate of mailing indicating that the above captioned patent application has been deposited as "Express Mail" with the United States Postal Service;
- ☐ 9. A certificate of mailing indicating that the above captioned patent application has been deposited with the United States Postal Service with sufficient postage as first class mail;
- ☒ 10. A return postcard; and
- ☐ 11. A preliminary amendment.

	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038	2039	2040	2041	2042	2043	2044	2045	2046	2047	2048	2049	2050	2051	2052	2053	2054	2055	2056	2057	2058	2059	2060	2061	2062	2063	2064	2065	2066	2067	2068	2069	2070	2071	2072	2073	2074	2075	2076	2077	2078	2079	2080	2081	2082	2083	2084	2085	2086	2087	2088	2089	2090	2091	2092	2093	2094	2095	2096	2097	2098	2099	2100	2101	2102	2103	2104	2105	2106	2107	2108	2109	2110	2111	2112	2113	2114	2115	2116	2117	2118	2119	2120	2121	2122	2123	2124	2125	2126	2127	2128	2129	2130	2131	2132	2133	2134	2135	2136	2137	2138	2139	2140	2141	2142	2143	2144	2145	2146	2147	2148	2149	2150	2151	2152	2153	2154	2155	2156	2157	2158	2159	2160	2161	2162	2163	2164	2165	2166	2167	2168	2169	2170	2171	2172	2173	2174	2175	2176	2177	2178	2179	2180	2181	2182	2183	2184	2185	2186	2187	2188	2189	2190	2191	2192	2193	2194	2195	2196	2197	2198	2199	2200	2201	2202	2203	2204	2205	2206	2207	2208	2209	2210	2211	2212	2213	2214	2215	2216	2217	2218	2219	2220	2221	2222	2223	2224	2225	2226	2227	2228	2229	2230	2231	2232	2233	2234	2235	2236	2237	2238	2239	2240	2241	2242	2243	2244	2245	2246	2247	2248	2249	2250	2251	2252	2253	2254	2255	2256	2257	2258	2259	2260	2261	2262	2263	2264	2265	2266	2267	2268	2269	2270	2271	2272	2273	2274	2275	2276	2277	2278	2279	2280	2281	2282	2283	2284	2285	2286	2287	2288	2289	2290	2291	2292	2293	2294	2295	2296	2297	2298	2299	2300	2301	2302	2303	2304	2305	2306	2307	2308	2309	2310	2311	2312	2313	2314	2315	2316	2317	2318	2319	2320	2321	2322	2323	2324	2325	2326	2327	2328	2329	2330	2331	2332	2333	2334	2335	2336	2337	2338	2339	2340	2341	2342	2343	2344	2345	2346	2347	2348	2349	2350	2351	2352	2353	2354	2355	2356	2357	2358	2359	2360	2361	2362	2363	2364	2365	2366	2367	2368	2369	2370	2371	2372	2373	2374	2375	2376	2377	2378	2379	2380	2381	2382	2383	2384	2385	2386	2387	2388	2389	2390	2391	2392	2393	2394	2395	2396	2397	2398	2399	2400	2401	2402	2403	2404	2405	2406	2407	2408	2409	2410	2411	2412	2413	2414	2415	2416	2417	2418	2419	2420	2421	2422	2423	2424	2425	2426	2427	2428	2429	2430	2431	2432	2433	2434	2435	2436	2437	2438	2439	2440	2441	2442	2
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total claims	18
total ind claims	3

<input checked="" type="checkbox"/>	A check in the amount of \$ 420.00
<input type="checkbox"/>	Please charge Deposit Account No.
	A duplicate sheet is attached.

Respectfully submitted,
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SIG99002

PATENT APPLICATION

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Applicant: Libor Nouzovsky et al. Examiner:
Serial No. Art Group:
Filing Date: Docket No. SIG99002
Title: Method and Apparatus for Recovering Data That was Transported Utilizing Multiple Data Transport Protocols

2/8/99

To the Honorable Commissioner
of Patents and Trademarks
Washington, D.C. 20231

STATEMENT OF STATUS AS SMALL ENTITY
Pursuant to 37 C.F.R. Section 1.27 and Section 1.9

For the above captioned patent application, a party in interest avers that it qualifies for small entity status as SMALL BUSINESS CONCERN. To verify the small entity status, the party in interest attests that:

1. This verified statement for the above captioned patent application or patent is being submitted prior to or with the first fee paid as a small entity;
2. For purposes of this verified statement, as defined in 37 C.F.R. Section 1.27, a license to a Federal agency resulting from a funding agreement with that agency pursuant to 35 U.S.C. 202 (c) (4) does not constitute a license.
3. As a SMALL BUSINESS CONCERN:
 - (a) I swear that I am an official of SigmaTel, Inc., empowered to act on behalf of SigmaTel, Inc.,
 - (b) In my capacity as identified in this section 3(a), I swear that SigmaTel, Inc. qualifies as a small business concern as defined in 37 C.F.R Section 1.9 and that the number of employees of SigmaTel, Inc. and those of its affiliates, does not exceed 500 persons;
 - (c) I further swear that my signature appears at the end of this Statement of Status as Small Entity;
 - (d) I still further swear that, in support my of contention that SigmaTel, Inc. qualifies as a small business concern, exclusive rights to the invention of the above captioned patent application have been conveyed to and remain with SigmaTel, Inc.,

Signatures of Person(s) Making the Verified Statement

SigmaTel, Inc.
Name: H. Spence Jackson

Signature
Title: President, CEO

Date

2/8/99

METHOD AND APPARATUS FOR RECOVERING DATA THAT WAS
5 **TRANSPORTED UTILIZING MULTIPLE DATA TRANSPORT PROTOCOLS**

TECHNICAL FIELD OF THE INVENTION

This invention relates generally to data transmissions and more particularly to
10 data transmissions that utilize multiple data transport protocols such as USB and IR data
transport protocols.

BACKGROUND OF THE INVENTION

15 Data transmission techniques for transmitting data from one device to another
device, wherein the devices are physically proximal (e.g., in the same room, the same
building, or within a few thousand feet) to one another, are known. Such data
transmission techniques utilize a particular transport medium (e.g., radio frequency (RF),
infrared (IR), fiber optics, and/or wires) and a particular data transport protocol. For
20 example, data transmissions utilizing an IR transport medium may be processed in
accordance with an IrDA specified slow or fast IR data transport protocol, Amplitude
Shift Keying (ASK) data transport protocol, or pulse code modulation (PCM) data
transport protocol. Correspondingly, each of the transport mediums may be defined in
accordance with standardized data transport protocols.

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One such standardized data transport protocol is the Universal Serial Bus (USB)
protocol, which prescribes data transmissions via a USB port. As is known, current state
of the art computers include a USB port enabling the computer to communicate with a
device (e.g., another computer, a printer, backup tape drive, etc.) at a rate up to 12 Mega
30 Bits per second (Mbps). For the devices to communicate, they must be coupled via a
cable that is capable of supporting such high speed data. As is also known, high speed

data cables require shielding and low active and passive impedances, which add to the cost of the cable (e.g., approximately \$20US for a six foot cable from a commercial retailer). In addition, if the USB port is incorporated into a laptop computer, a transient user would need to carry a USB cable.

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To reduce the impact of utilizing the USB port (i.e., its cost and need for a special cable), a proposal was introduced in 1997 entitled "Universal Serial Bus IrDA Bridge Device Definition" (hereinafter the USB/IrDA Device) that suggested replacing the USB cable with IR transceivers. The USB/IrDA Device was specified to include a USB
10 device controller, USB interface firmware, USB/IrDA bridge device firmware, IrDA interface firmware, and an IrDA transceiver. In general, the USB/IrDA Device was to receive data from a host (e.g., a computer) in accordance with the USB data transport protocol. As such, the host packetizes the data and sends the packets to the USB/IrDA Device. Upon receiving the packets, the USB device controller reconstructs the data and,
15 via the USB interface firmware, provides the reconstructed data to the USB IrDA bridge device firmware. The USB IrDA bridge device firmware processes the data in accordance with an IrDA data transport protocol (e.g., slow or fast IR) to produce a frame of IR data. The IR data is provided to the IrDA transceiver via the IrDA interface firmware.

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An issue with the USB/IrDA Device is that it requires a microprocessor, microcontroller, or digital signal processor to efficiently perform the significant amount of processing. Currently, such microprocessors, microcontrollers, or digital signal processors cost as much, if not more, than the USB cable. Thus, a main benefit of the
25 USB/IrDA Device, i.e., less cost than the USB cable, is lost.

Therefore, a need exists for a method and apparatus that overcomes the above mentioned limitations of USB cables and the USB/IrDA Device.

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BRIEF DESCRIPTION OF THE DRAWINGS

Figure 1 illustrates a schematic block diagram of a computer and device in accordance with the present invention;

Figure 2 illustrates a schematic block diagram of a USB/IR module in accordance
5 with the present invention;

Figure 3 illustrates a graphical representation of data transport conversion in accordance with the present invention;

10 Figure 4 illustrates a schematic block diagram of an alternate embodiment of a USB/IR module in accordance with the present invention;

Figure 5 illustrates a logic diagram of a method for providing USB to IR data transmissions in accordance with the present invention;
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Figure 6 illustrates a logic diagram of a method for providing USB to IR data transmissions in accordance with the present invention;

Figure 7 illustrates a logic diagram of a method for transporting data utilizing
20 multiple data transports protocols in accordance with the present invention; and

Figure 8 illustrates a logic diagram of a method for recovering data that was transported utilizing multiple data transport protocols in accordance with the present invention.
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Detailed Description of a Preferred Embodiment

Generally, the present invention provides a method and apparatus that includes processing for recovering data that was transported utilizing multiple data transport
30 protocols. Such processing begins by receiving formatted data and decoding the formatted data in accordance with a second data transport protocol. The decoding

recaptures a first formatted data and a first data transport identifier. The processing then continues by decoding the first formatted data in accordance with a first data transport protocol based on the first data transport identifier. For example, if the first data transport protocol is one of the IrDA data transport protocols and the second data transport protocol is the USB data transport protocol, the decoding of the formatted data is to recapture the data that is formatted in accordance with the IrDA protocol, where the first transport identifier includes information that identifies the start of IrDA formatted data and its length. It turn, by decoding the IrDA formatted data, the original data is recaptured. With such a method and apparatus, a transceiving module that transports multi-formatted data does not require extensive processing power. For example, a USB/IR module that receives USB data packets, which include the original data that has first been formatted in accordance with the IrDA data transport protocol, does not require sophisticated processing. Therefore, a USB/IR module in accordance with the present invention has significantly less cost than the USB/IrDA Device as previously discussed.

The present invention can be more fully described with reference to Figures 1 through 8. Figure 1 illustrates a schematic block diagram of a computer 10 operably coupled via an IR communication path to a device 12. The computer 10 includes a motherboard 14, system memory 16, and a USB port 18. The motherboard 14 includes a central processing unit 20, and a USB processor 22 that are operably coupled via a bus to the system memory 16. The USB processor 22 is also coupled to the USB port 18. As one of average skill in the art would readily appreciate, the computer 10 includes more circuitry than shown in Figure 1, however, such additional circuitry is not germane to the present invention thus, for the sake of clarity, such other circuitry has been omitted.

The system memory 16 stores a USB/IR driver software module 17, which is executed by the central processing unit 20 to prepare data for transport via the USB port 18. The data being transported by the central processing unit 20 may be data generated via execution of an application (e.g., word processing, drawings, etc.), a file transfer, HTML documents, etc. In operation, the central processing unit 20, via execution of the USB/IR driver 17, prepares the data for transport by first formatting it in accordance with

an IrDA data transport protocol. Such an IrDA transport protocol may be for fast IR, medium IR, slow IR, amplitude shift keying, pulse position modulation, etc. In addition, the driver 17 includes instructions that cause the CPU 20 to generate frame identifying information (i.e., first format identifying information) that specifies, at a minimum, the start of an IR data frame and the length of the IR data frame. Having formatted the data in accordance with an IrDA data transport protocol, the central processing unit 20 provides the IR formatted data and the frame identifying information to the USB processor 22. The USB processor, utilizing at least a portion of the USB IR driver software, prepares the IR formatted data and the frame identifying information in accordance with the USB data transport protocol. As such, the USB processor packetizes the IR formatted data and the frame identifying information. The USB packets are then transported via the USB port to the USB IR module 24.

The USB IR module 24 includes a USB to IR section 26 and an IR transceiver section 28. The USB to IR section 26 receives the USB data packets, strips off the USB header information to recapture the IR formatted data and the frame identifying information. The USB to IR section 26 utilizes the frame identifying information to determine when it has recaptured a full frame of the IR formatted data. Upon receiving a full frame of IR formatted data, the USB to IR section 26 provides the full frame of recaptured IR formatted data to the IR transceiver section 28. The IR transceiver section 28 converts the IR formatted data, which is a digital format, into pulses that are transmitted utilizing a transmitting LED.

The device 12 includes a USB processor 30, a processor 32, memory 34 and a USB port 36. Coupled to the USB port 36 is a USB/IR module 38. The USB/IR module 38 receives the infrared transmitted pulses from USB/IR module 24 via the IR transceiver section 42. The IR transceiver section 42 converts the infrared pulses into digital data. As the digital data is stored, the USB to IR section 40 converts the stored data into USB packets. The USB packets are then provided to the USB processor 30 via the USB port 36. As the USB processor 30 receives the USB packets, it removes the USB header

information to recapture the IR formatted data. Recall that the data however is IR data, i.e., has been formatted in accordance with an IrDA data transport protocol.

The processor 32 executes the USB/IR driver 33, which is stored in memory 34, to recapture the original data from the IR formatted data. As such, by having the processors 20 and 32 prepare the data in accordance with an IrDA data transport protocol, the USB modules 24 and 38 are not required to do such formatting. As such, the USB modules 24 and 38 can include significantly less processing than the USB/IrDA Device as previously mentioned. As such, the USB/IR modules 24 and 38 only need to include enough processing to remove the USB header information, to recognize when a full frame of data has been received, encode the digital IR formatted data into pulses, and to decode pulses to recapture IR formatted data.

Figure 2 illustrates a schematic block diagram of the USB 24 or 38. The USB module 24 or 38 includes a clock sync module 50, a USB packet identifier 52, a packet interpreting module 54, a CRC module 56, an end of packet module 58, a valid packet module 60, an IR encoder 62, a transmit buffer 64, a data router 66, a received buffer 68, an IR decoder 70, a USB/IR address module 72, a USB/IR module descriptor 74, a light transmitting diode 76, and a light receiving diode 78. The USB/IR module 24 or 38 also includes a received USB bus and a transmit USB bus operably coupled to receive USB data packets 82 and to transmit USB data packets 80. In one embodiment, the transmit and receive paths are a single bus that are operated in a half duplex manner.

The clock sync module 50 is operably coupled to the bus to determine a clock signal from the data packets being transported over the bus. The clock sync module 50 includes a clock circuit that has a frequency approximately equal to the data rate of the USB port, which may be in the range of 1.5 megabits per second to 12 megabits per second. As such, the clock sync module 50 functions to synchronize the internal clock with the data being transported via the bus. The synchronized clock is provided to the other modules within the USB/IR module 24 or 38.

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The peripheral device address is provided to the USB/IR module 24 and stored within the USB/IR address module 72. As such, the data router 66 includes sufficient processing to recognize when the incoming or outgoing data is data or configuration data.

Figure 3 illustrates a graphic representation of data transporting in accordance with the present invention. The illustration of Figure 3 assumes that data is being transported between two devices that include central processing units. The data transport process begins when the sending CPU creates data 90. The sending CPU then prepares for IR data transportation by executing the USB/IR driver 17. By executing the driver 17, the CPU prepares an IR header 93 and IR formatted data. The IR formatted data includes, for FIR, an IR preamble 92, an IR start flag 94, the data 96, and an IR stop flag 98. The IR header 93 includes data that identifies the being of the IR formatted data and the length of the IR formatted data.

The sending USB processor receives the IR formatted data and the IR header 93 and packetizes the data to produce USB packets. Each of the USB packets includes a USB header 100 and a payload 102, 104 and 106. The payload 102, 104, and 106 corresponds to portions of the IR data (i.e., the IR header and the IR formatted data). As shown, payload 102 stores the IR header 93, the IR preamble 92 and a portion of the IR start flag 94. Payload 104 stores the remainder of the IR start flag and a portion of the data 96. Payload 106 stores the remainder of the data and the IR stop flag. The sending USB processor transports the USB packets to the sending USB/IR module via the USB ports.

The sending USB/IR module receives the USB data packets and removes the USB header 100. The payloads are then buffered to produce buffer data 100. Note that the sending USB/IR module buffers the payloads until it determines that a full frame of IR formatted data has been stored. This may be done by interpreting the IR header to recognize the start of the IR formatted data and to determine its length. From this information, the sending USB/IR module can readily determine a full frame of IR formatted data. Alternatively, the sending USB/IR module may be programmed to

5 The sending USB/IR module then IR encodes the buffer data. For example, assume that the buffer data 108 begins with the binary digits of 01001110. Further assume that the IR formatted data and the IR encoding is in accordance with the four pulse position module technique. As such, each time chip 110 includes four time slots 112. Thus, when the pulse is in the first time slot of the chip, it represents the binary value 00, when in the second time slot, it represents the binary value 01, in the third time slot it represents 10, and in the fourth slot it represents 11.

By having the sending and receiving CPUs perform the IR transport protocol
25 formatting and deformatting, the USB/IR modules 24 and 38 need only include sufficient
processing to recognize and interpret the IR header, or to recognize the preamble 92, start
flag 94, and stop flag 98 within the pay loads 100 to 104 and 106. Having recaptured this
information, the buffered data 108 is in the IR transport data format, which is readily
encoded into IR pulses. Therefore, the USB/IR modules 24 and 38 do not require
30 expensive processors to perform its functionality thus is significantly less costly to
produce than the USB/IR Device.

Figure 4 illustrates a schematic block diagram of a USB/IR module 120 that includes a processing module 122 and memory 124. The processing module 122 may be a single processing device or a plurality of processing devices. Such a processing device
 5 may be a limited functionality microprocessor, microcontroller, digital signal processor, state machine and/or logic circuitry. The memory may be read-only memory, random access memory, reprogrammable memory and/or any circuitry that stores operational instructions. Note that when the processing module 122 performs one or more of its functions utilizing a state machine or logic circuitry, the memory storing the
 10 corresponding operational instructions is embedded within the circuitry comprising the state machine or logic circuit. The operational instructions stored in memory 124 and executed by processing module 22 are illustrated in Figures 5 and 6.

Figure 5 illustrates a logic diagram of a method for providing USB to IR
 15 transmissions. The process begins at step 130 where USB data packets are received, wherein each USB data packet includes a payload and USB overhead data. Note that the USB overhead data is prescribed in the USB specification. The process then proceeds to step 132 where the USB data packets are interpreted to determine IR frame delineation information. The IR frame identifying information includes a header and IR frame link
 20 information.

The process then proceeds to step 134 where a determination is made as to whether the data being received within the USB packets is data or configuration data. When the data is configuration data, the process proceeds to step 136 where a response is
 25 prepared in accordance with the configuration data. Note that the configuration data includes a request for peripheral device description information or a peripheral device address. Such configuration information is typically requested and transported during the initial boot-up of the computer system or upon reboots of the computer system.

30 If the USB data being received is data, the process proceeds to step 138 where the data is extracted from the payload. The process then proceeds to step 140 where the

extracted data is stored based on the IR frame identifying information. In other words, based on the length of the IR frame, a sufficient amount of memory is allocated. When that memory is full, a full frame of IR data has been stored. The process then proceeds to step 142 where the stored frame of data is encoded in accordance with an IR data transport protocol. The encoding typically will not occur until the encoding is enabled, which occurs when the IR frame identifying information indicates that a full frame has been stored and/or when requested by the CPU. In other words, when the allocated memory has been fully utilized, a full frame is stored and the encoding can commence. Note that the IR transport protocol may be in accordance with the slow IR IrDA protocol, medium IR IrDA protocol, the fast IR IrDA protocol and/or amplitude shift keying. Further note that the USB/IR module does not generate the preamble, start flag or stop flag for these protocols, it merely takes the digital data and converts it to IR pulse information. The process then proceeds to step 144 where the IR encoded data is transported.

Figure 6 illustrates a logic diagram for receiving USB to IR data transmissions. The process begins at step 150 where IR encoded data is received. The process then proceeds to step 152 where the IR encoded data is decoded in accordance with the IR data transport protocol. In other words, the received IR pulses are converted into digital information based on the data transport protocol. This was illustrated and described previously with respect to Figure 3.

The process then proceeds to step 154 where the decoded data is stored. The process then proceeds to step 156 where the stored data is packetized in accordance with the USB data transport protocol. Typically, the packetizing of the decoded data will occur in response to a request for USB data packets from the host.

Figure 7 illustrates a logic diagram of a method for transporting data utilizing multiple data transport protocols, which may be executed by the computer 10 and/or the device 12. The process begins at step 160 where data is formatted in accordance with a first data transport protocol. The first data transport protocol is one of many data

transport protocols that include slow speed USB, an infrared transport protocol, fast speed USB, slow or medium IR in accordance with an IrDA specified infrared data transport protocol, a fast IR in accordance with the IrDA specified infrared data transport protocol, and amplitude shift-keying. Note that if the first data transport protocol is the slow or fast IR in accordance with the IrDA specified infrared transport protocol, and the second data transport protocol is the slow speed USB or the fast speed USB (12 megabits per second, while the slow speed is 1 1/2 megabits per second), the frame of data is delineated by IR frame delineation information, which acts as the transport identifying information. Further note that the first data transport protocol may be identified based on connectivity information (i.e., the host recognizes that it is coupled to a USB/IR module). Still further note that the formatting of the data may require portions of the data to be altered when such data would be confused with frame delineation information. For example, the preamble may include data of 0xC0 which if unaltered indicates a portion of the start flag, stop flag or preamble, the data is converted into 0x7D.

The process then proceeds to step 162 where the first data transport identifying information is provided along with the first encoded first formatted data. Note that the first data transport identifying information may be generated as IR frame delineation information when the USB to IR conversion is being performed. Further note that the IR frame delineation information may include an identifying header and an IR frame link value, or information.

The process then proceeds to step 164 where the first formatted data and the first data transport identifying information are formatted in accordance with a second data transport protocol. For example, if the first data transport protocol is in accordance with an IrDA data transport protocol, and the second is in accordance with the USB data transport protocol, the resulting data packets from step 164 are in accordance with the USB data transport protocol. The process then proceeds to step 166 where the second formatted data is transported via a port, such as a USB port.

Figure 8 illustrates a logic diagram of a method for recovering data that was transported using multiple data transport protocols, which may be executed by the computer 10 and/or the device 12. The process begins at step 170 where formatted data is received. As the formatted data is received, or prior to, a first data transport protocol and a second data transport protocol may be identified based on connectivity information. Such connectivity information is usually determined during the boot-up of the computer or device where it recognizes peripherals attached thereto, identifies the peripheral and assigns an address.

The process then proceeds to step 174 where the formatted data is decoded in accordance with a second data transport protocol to recapture first formatted data and first data transport identifying information. Note that the first and second data transport protocols may be one of the USB data transport protocols or one of the IrDA data transport protocols. When the first data transport protocol is in accordance with an IrDA data transport protocol, the first data transport identifying information may be IR frame delineation information that includes an identifying header and IR frame link information.

The process then proceeds to step 176 where the first formatted data is decoded in accordance with a first data transport protocol based on the first data transport identifying information to recover the data. Note that if the encoded data had portions of it that were altered due to violations of the data transport protocol, the altered portions are re-altered to recapture the original data.

The preceding discussion has presented a method and apparatus for providing an efficient and economical USB to IR transport module. By including a USB/IR driver that is executable by the central processing unit, the central processing unit performs the operational intensive function of preparing the data in accordance with an IrDA data transport protocol. In addition, the CPU adds an IR header to the prepared IR frame of data. The IR header indicates the beginning of the new IR frame and the length of the frame. Based on this information, the USB/IR module needs to include sufficient

processing to recognize the IR header and to allocate sufficient memory to store the IR frame of data. As such, simple processing circuits may be employed in the USB/IR module making it more cost effective than the USB/IR Device.

CLAIMS

1. A method for recovering data that was transported utilizing multiple data transport protocols, the method comprises the steps of:

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a) receiving formatted data;

b) decoding the formatted data in accordance with a second data transport protocol of the multiple data transport protocols to recapture first formatted data and first data transport identifying information; and

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c) decoding the first formatted data in accordance with a first data transport protocol or the multiple data transport protocols based on the first data transport identifying information to recover data.

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2. The method of claim 1, wherein the multiple data transport protocols include at least two of: slow speed universal serial bus (USB), an infrared transport protocol, fast speed USB, slow IR in accordance with an IrDA specified infrared data transport protocol, medium IR in accordance with the IrDA specified infrared data transport protocol, fast IR in accordance with the IrDA specified infrared data transport protocol, and amplitude shift keying (ASK).

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3. The method of claim 2, wherein the first data transport protocol is the slow IR, medium IR, or the fast IR in accordance the IrDA specified infrared data transport protocol and the second data transport protocol is the slow speed USB or the fast speed USB, and wherein step (b) further comprises decoding an IR frame delineation information as the data transport identifying information.

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4. The method of claim 3, wherein the IR frame delineation information includes an identifying header and IR frame length information.

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7. A data communication device comprises:

a processing module; and

5 memory operably coupled to the processing device, wherein the memory store operational instructions that, when processed by the processing module, cause the processing module to (a) receive formatted data; (b) decode the formatted data in accordance with a second data transport protocol of the multiple data transport protocols to recapture first formatted data and first data transport identifying information; and (c)
10 decode the first formatted data in accordance with a first data transport protocol or the multiple data transport protocols based on the first data transport identifying information to recover data.

15 8. The data communication device of claim 7, wherein the multiple data transport protocols include at least two of: slow speed universal serial bus (USB), an infrared transport protocol, fast speed USB, slow IR in accordance with an IrDA specified infrared data transport protocol, medium IR in accordance with the IrDA specified infrared data transport protocol, fast IR in accordance with the IrDA specified infrared
20 data transport protocol, and amplitude shift keying (ASK).

9. The data communication device of claim 8, wherein the first data transport protocol is the slow IR, medium IR, or the fast IR in accordance the IrDA specified infrared data transport protocol and the second data transport protocol is the slow speed
25 USB or the fast speed USB, and wherein the memory further comprises operational instructions that cause the processing module to decode IR frame delineation information as the data transport identifying information.

10. The data communication device of claim 9, wherein the IR frame delineation
30 information includes an identifying header and IR frame length information.

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13. A digital storage medium for storing operational instructions that, when read by a processing unit, cause the processing unit to transport data utilizing multiple data transport protocols, the digital storage medium comprises:

5 first storage means for storing operational instructions that cause the processing module to receive formatted data;;

second storage means for storing operational instructions that cause the processing module to decode the formatted data in accordance with a second data transport protocol of the multiple data transport protocols to recapture first formatted data and first data transport identifying information; and;

third storage means for storing operational instructions that cause the processing module to (c) decode the first formatted data in accordance with a first data transport protocol or the multiple data transport protocols based on the first data transport identifying information to recover data.

14. The digital storage medium of claim 13, wherein the multiple data transport protocols include at least two of: slow speed universal serial bus (USB), an infrared transport protocol, fast speed USB, slow IR in accordance with an IrDA specified infrared data transport protocol, medium IR in accordance with the IrDA specified infrared data transport protocol, fast IR in accordance with the IrDA specified infrared data transport protocol, and amplitude shift keying (ASK).

15. The digital storage medium of claim 14, wherein the first data transport protocol is the slow IR, medium IR, or the fast IR in accordance the IrDA specified infrared data transport protocol and the second data transport protocol is the slow speed USB or the fast speed USB, and wherein the second storage means further comprises operational instructions that cause the processing module to decode IR frame delineation information (e.g., preamble, start and stop flags) as the data transport identifying information.

16. The digital storage medium of claim 15, wherein the IR frame delineation information includes an identifying header and IR frame length information.

5 17. The digital storage medium of claim 13 further comprises storage means for storing operational instructions that cause the processing module to identify the first data transport protocol based on connectivity information prior to decoding the first formatted data.

10 18. The digital storage medium of claim 13 further comprises storage means for storing operational instructions that cause the processing module to alter a portion of the data when the portion of the data corresponds to reserved data.

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A method and apparatus that includes processing for recovering data that was transported utilizing multiple data transport protocols, where such processing begins by receiving formatted data and decoding the formatted data in accordance with a second data transport protocol. The decoding recaptures a first formatted data and a first data transport identifier. The processing then continues by decoding the first formatted data in accordance with a first data transport protocol based on the first data transport identifier. For example, if the first data transport protocol is one of the IrDA data transport protocols and the second data transport protocol is the USB data transport protocol, the decoding of the formatted data is to recapture the data that is formatted in accordance with the IrDA protocol, where the first transport identifier includes information that identifies the start of IrDA formatted data and its length. It turn, by decoding the IrDA formatted data, the original data is recaptured.

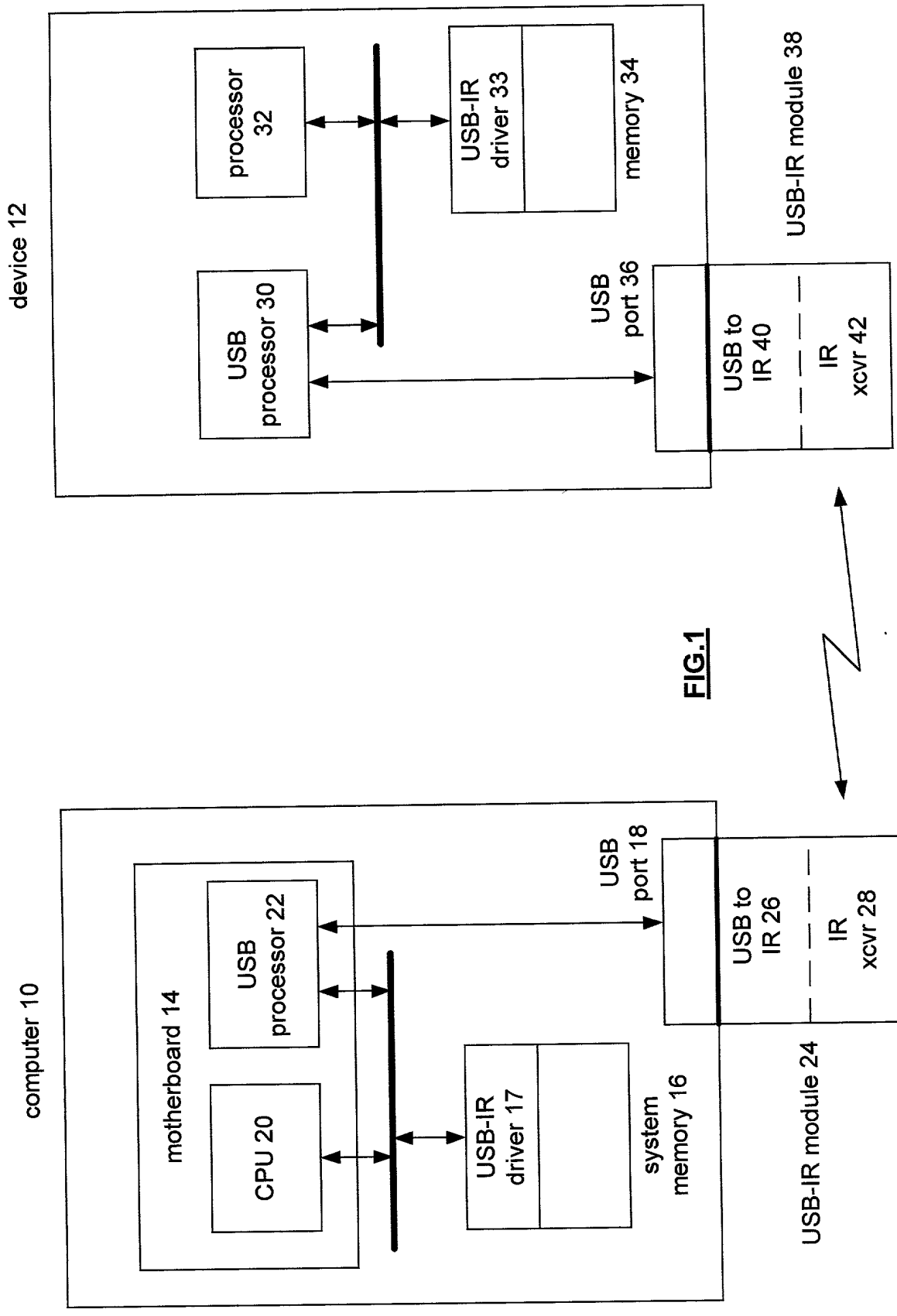


FIG.1

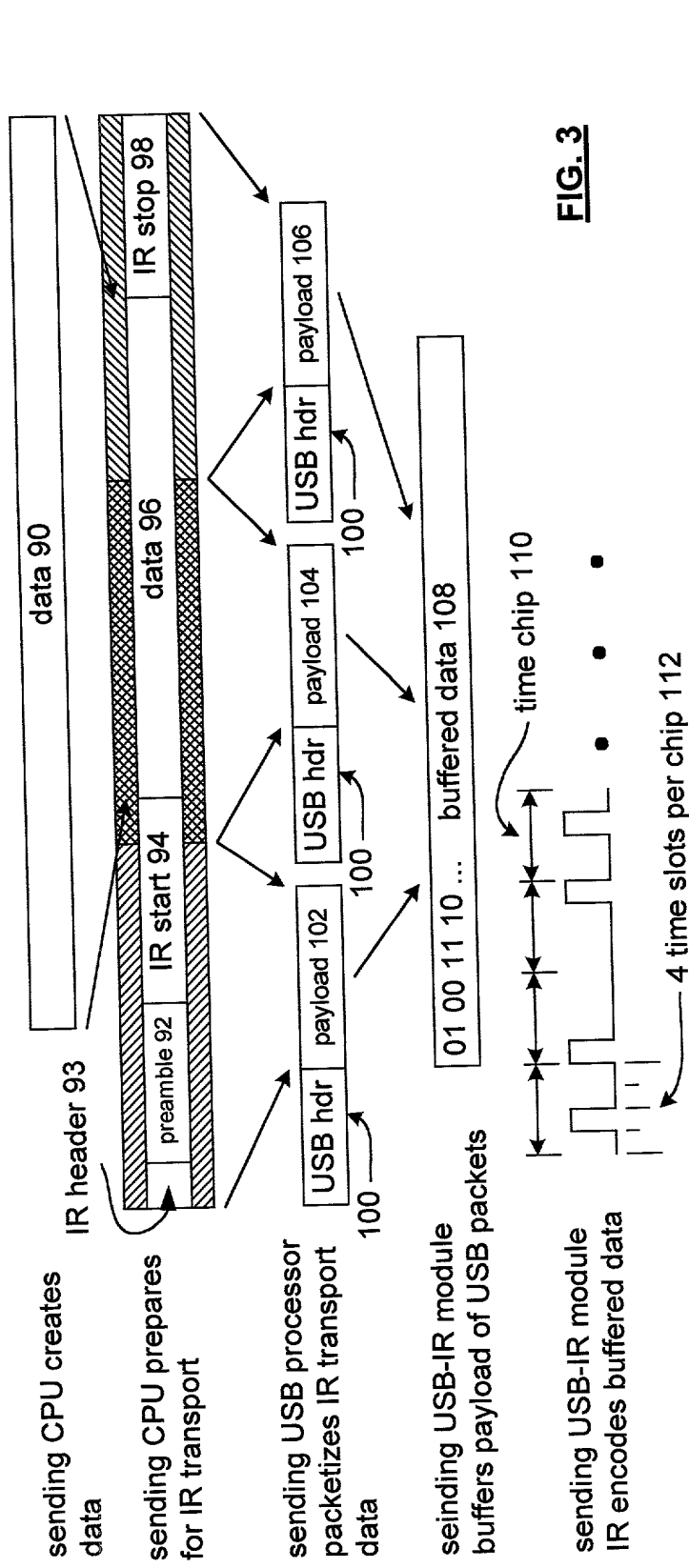
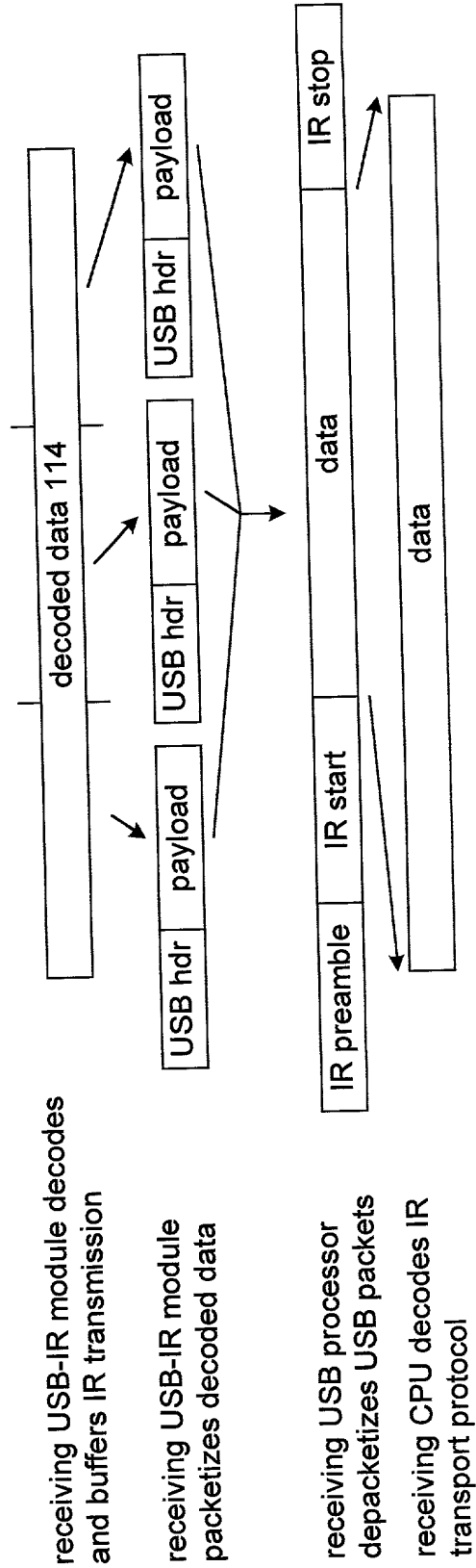


FIG. 3



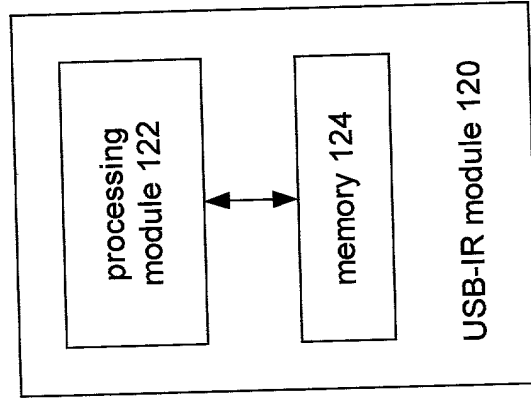


FIG. 4

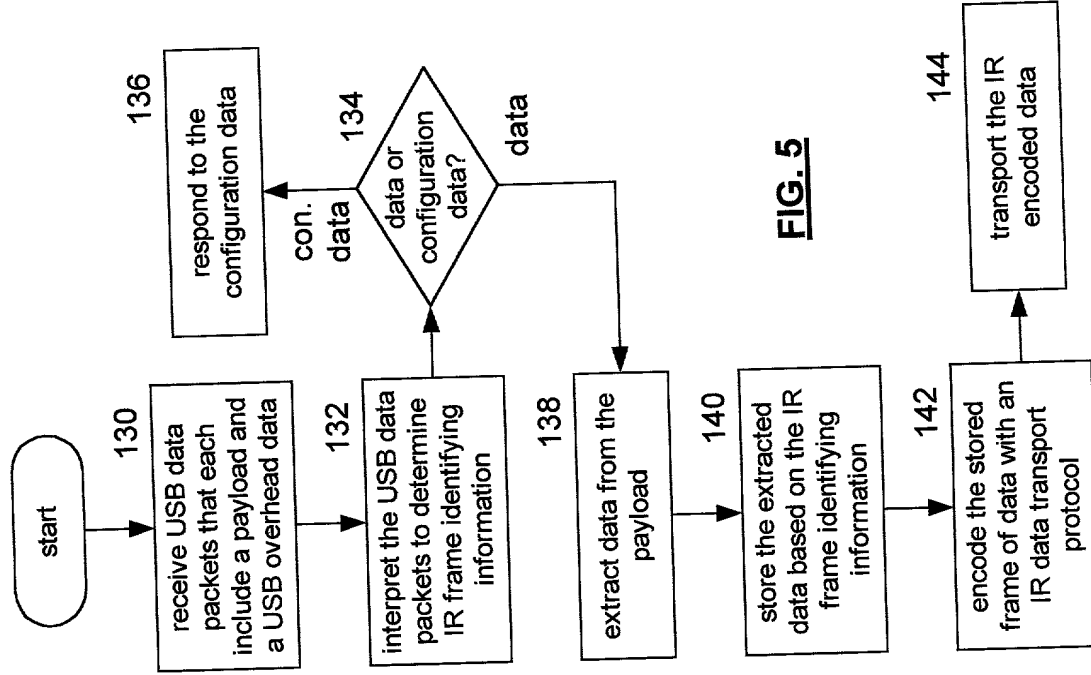


FIG. 5

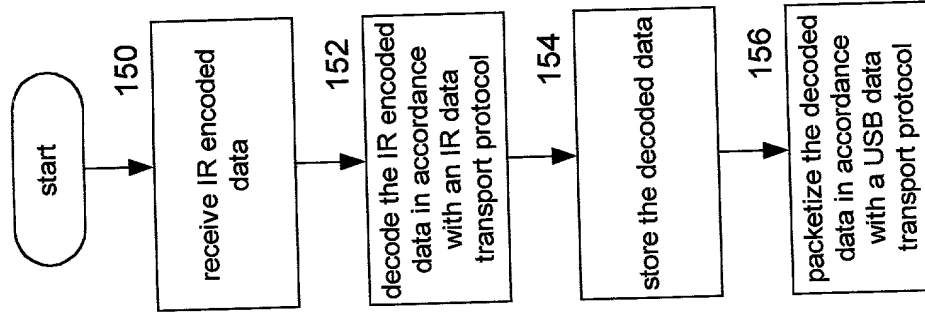


FIG. 6

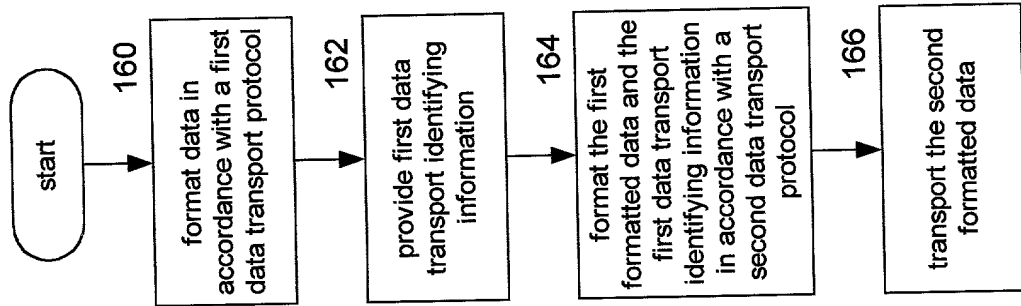


FIG. 7

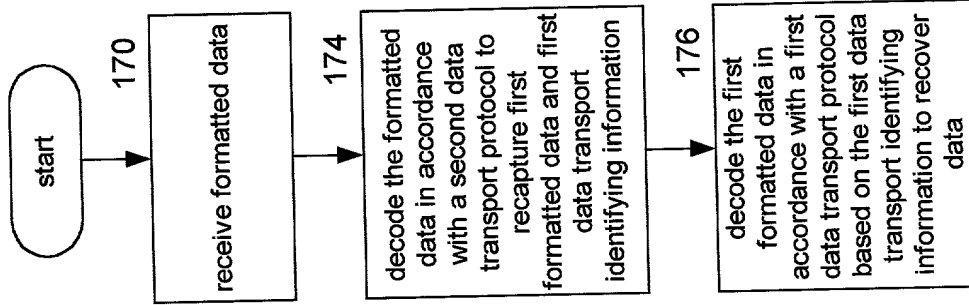


FIG. 8

DECLARATION AND POWER OF ATTORNEY
Pursuant to 37 C.F.R 1.63 and 1.67

As a below named inventor, I hereby declare that:
My residence, post office address and citizenship are as stated below next to my name; and
I believe that I an inventor of the subject matter of a patent application entitled:

METHOD AND APPARATUS FOR RECOVERING DATA THAT WAS TRANSPORTED UTILIZING
MULTIPLE DATA TRANSPORT PROTOCOLS

The specification for the patent application (check one):

- ☒ is attached hereto.
- ☐ was filed on _____ as Application Serial No. _____
and was amended on _____ (if applicable).
- ☐ was filed as PCT International Application No. PCT/ _____ on _____
and was amended on _____ (if applicable).
- ☐ was filed on _____ as Application Serial No. _____
and was issued a Notice of Allowance on _____

I hereby state that I have reviewed and understood the contents of the above identified patent application, including the claims as amended by any amendment referred to above or as allowed as indicated above.

I acknowledge the duty to disclose all information known to me to be material to the patentability of this patent application as defined in 37 C.F.R. Section 1.56. If this is a continuation-in-part (CIP) application, insofar as the subject matter of each of the claims of this application is not disclosed in the prior United States application in the manner provided by the first paragraph of 35 U.S.C. Section 112, I acknowledge the duty to disclose to the Office all information known to me to be material to patentability of the application as defined in 37 C.F.R. Section 1.56 which became available between the filing data of the prior application and the national or PCT international filing date of this CIP application.

I hereby claim foreign priority benefits under 35 U.S.C. Sections 119 and 365 of any foreign application(s) for patent(s) or inventor's certificate(s) listed below. I have also identified below any foreign application(s) for patent(s) or inventor's certificate(s) filed by me or my assignee which: disclose the subject matter claimed in this patent application; and have a filing date that is either: (1) before the filing date of the application on which my priority is claimed; or, (2) before the filing date of this application when no priority is claimed:

Prior Foreign Patents
(list number, country, filing date MDY, date laid open, date granted or patented)

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I hereby claim the benefit under 35 U.S.C. Sections 120 and 365 of any United States application(s) listed below and PCT international application(s) listed below:

Prior U.S. or PCT Applications		
Application No.	Mo/Day/Yr Filed	Status
<input type="text"/>	<input type="text"/>	<input type="text"/>

I hereby appoint Timothy W. Markison, Registration No. 33,534 of SigmaTel Inc., 6101 West Courtyard Drive, Austin, Texas 78730 as my attorney, with full power of substitution and revocation, to prosecute this patent application and to transact all business in the United States Patent and Trademark Office connected therewith, and to file and prosecute any international patent applications filed thereon before any international authorities under the Patent Cooperation Treaty, and I hereby authorize him to act and rely on instructions from and communicate directly with the person/assignee/attorney/firm/organization who/which first sent this case to them and by whom/which I hereby declare that I have consented after full disclosure to be represented unless/until I instruct them in writing to the contrary.

Please address all correspondence and direct all telephone calls to:

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Fax: (512) 343-6199

I hereby declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under Section 1001 of Title 18 of the United States Code, and that such willful false statements may jeopardize the validity of this patent application or any patent issued thereon.

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	citizen of:	Signature: _____ Date: _____
	citizen of:	Signature: _____ Date: _____
	citizen of:	Signature: _____ Date: _____
	citizen of:	Signature: _____ Date: _____